Wherever they are found in the biosphere, living organisms are necessarily linked to their environment. Ecosystems are dynamic and communities change over time in response to abiotic or biotic changes in the environment. For example, the climate may be become warmer or colder, wetter or drier, or the food chain may be disrupted by the loss of a particular population or the introduction of a new one. Species must be able to adapt to these changes in order to survive. As they adapt, the organisms themselves undergo change. Evolution is the gradual change in the genetic makeup of a population of a species over time. It is important to note that it is the population that evolves, rather than individuals.

A species evolves to a particular niche either by adapting to use a niche's environment or adapting to avoid competition with another species. Recall that no two species can occupy the exact same niche in an ecosystem. The availability of resources is pivotal.

In the case of five warbler species which all consume insects of the same tree, to survive each species needs to gather its food (insects) in different parts of that tree. This avoids competition and the possible extinction of one or more species. Therefore, one of the bird species will adapt to hunting at the treetops; another the lowest branches; another the mid-section. In this way, these species have evolved into different, yet similar, niches. All five species in this way can survive by adapting to a narrow niche. Organisms with a narrow niche are called specialized species. Another example is a species that may evolve to a narrow niche by consuming only one type of leaf, such as the Giant Panda, which consumes bamboo leaves.

This strategy allows it to co-exist with another consumer by not competing with it. In both cases, species with a narrow niche are often vulnerable to extinction because they typically cannot respond to changes in the environment. Evolving to a new niche would take too much time for the specialized species under the duress of a drought, for example.

On the other hand, a species that can use many foods and locations in which to hunt or gather are known as generalized species. In the event of a drought, a generalized species such as a cockroach may be more successful in finding alternative forms of food, and will survive and reproduce.

Yet another form of evolution is co-evolution, where species adapt to one another by interacting closely. This relationship can be a predator-prey type of interaction. Prey is at risk, but as a species it has evolved chemical defenses or behaviors. On the other hand, co-evolution can be a mutualistic relationship, often characterized by the ants and an acacia tree of South America. The acacia provides ants with food and a habitat, and its large projecting thorns provides protection from predators. The ants, in turn, protect the tree by attacking any animal landing on it and by clearing vegetation at its base. So closely evolved are the species that neither can exist without the other.

Similar ecosystems may offer similar niches to organisms, that are adapted or evolved to that niche. Convergent evolution is the development of similar adaptations in two

species occupying different yet similar ecosystems. Two species evolve independently to respond to the demands of their ecosystem, and they develop the same mechanism to do so. What emerges are adaptations that resemble look-alikes: Wings of birds and bats are similar, but evolved separately to meet the demands of flying through air. The dolphin, a mammal, shares adaptations that allow for movement through water with the extinct reptile ichthyosaur. They have similar streamlined shapes of fins, head, and nose, which make the bodies better suited for swimming.

Natural selection is another process that depends on an organism's ability to survive in a changing environment. While evolution is the gradual change of the genetic makeup over time, natural selection is the force that favors a beneficial set of genes.

For example, birds migrating to an island face competition for the insects on a tropical tree. One genetic pool of a new generation may include a longer beak, which allows the bird to reach into a tropical flower for its nectar. When high populations of birds compete for insects, this ability to use the niche of collecting nectar favors that bird's survival. The long-beaked gene is passed to the next generation and the next, because birds can coexist with the insect-gathering birds by using a different niche. Through reproduction of the surviving longer-beaked birds, natural selection favors its adaptability.

A species, family or larger group of organisms may eventually come to the end of its evolutionary line. This is known as extinction. While bad news for those that become extinct, it's a natural occurrence that has been taking place since the beginning of life on earth. Extinctions of species are constantly occurring at some background rate, which is normally matched by speciation. Thus, in the natural world, there is a constant turnover of species.

Occasionally large numbers of species have become extinct over a relatively short geologic time period. The largest mass extinction event in the earth's history occurred at the end of the Permian period, 245 million years ago. As many as 96 percent of all marine species were lost, while on land more than 75 percent of all vertebrate families became extinct. Although, the actual cause of that extinction is unclear, the consensus is that climate change, resulting from sea level change and increased volcanic activity, was an important factor. The most famous of all mass extinctions occurred at the boundary of the Cretaceous and Tertiary periods, 65 million years ago. About 85 percent of species became extinct, including all of the dinosaurs. Most scientists believe that the impact of a small asteroid near the Yucatan Peninsula in Mexico triggered that extinction event. The impact probably induced a dramatic change in the world climate.

The most serious extinction of mammals occurred about 11,000 years ago, as the last Ice Age was ending. Over a period of just a few centuries, most of the large mammals around the world, such as the mammoth, became extinct. While climate change may have been a factor in their extinction, a new force had also emerged on the earth - modern humans. Humans, aided by new, sharp-pointed weapons and hunting techniques, may have hurried the demise of the large land mammals. Over the years, human activity has continued to send many species to an early extinction. The best

known examples are the passenger pigeon and the dodo bird, but numerous other species, many of them unknown, are killed off by over harvesting and other human-caused habitat destruction, degradation and fragmentation.